After the Gulf War: Balancing Spacepower's Development

by

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INTRODUCTION

Background and Significance of the Problem

> *It is a military axiom to take the high ground —and space is the ultimate high ground. In the Gulf War, US space forces were virtually unopposed, but in the future that may not be the case. . . . Without question, it was fortunate that there were six months to get ready. The next time, that luxury may not exist, and we must be prepared. . . . The first need is a key element—development of space doctrine to provide guidance and direction at all levels of war, across the full spectrum of conflict.*
>
> —Lt Col Steven J. Bruger

Early military applications of space-based assets bore little resemblance to their successful use in "the first information war."[1] The US developed most of its early space systems to serve the Cold War nuclear deterrence strategy. The need to protect space sources and methods resulted in a high degree of secrecy and organizational compartmentalization. As a result, when Desert Shield began the highly fragmented leadership of the space community lacked coherent doctrine, operated with an inherited top-down "technology push" for system requirements, and had little spacepower[2] experience. Spacepower was simply unprepared to support the theater Commander-in-Chief in other than the Cold War *strategic*[3] role.

The experiences of the Persian Gulf War confirmed these characteristics—the majority of the documented lessons concerned a lack of doctrine or a lack of space literacy/experience. In the development of spacepower, doctrine and experience have evolved much more slowly than the pace of technology. In the interim, have the US participants redressed the imbalance that existed

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in the development of spacepower as witnessed in Operation Desert Shield/Storm? At issue for space policy makers is the question of whether or not reforms in technology, experience, or doctrine will move the US Military Space Program toward a more robust warfighting capability.

From its meager beginnings in the Vietnam conflict, spacepower evolved dramatically. In Vietnam the military used space-based platforms primarily for weather forecasting, navigation assistance, and communications support. During Operation Urgent Fury in Grenada, US forces used the Fleet Satellite Communications (FLTSAT) and Leased Satellite Communications (LEASAT) Systems in a command and control role for the first time in a joint operation. Operation El Dorado Canyon in Libya and Operation Just Cause in Panama were the first major operations in which US forces used information from space-based national intelligence systems. [4] In addition, Operation El Dorado Canyon was the first operation in which a space system developed as a Tactical Exploitation of National Capabilities (TENCAP) project was used.[5]

Not until the Gulf War were US warfighters able to use the full array of civil, military, commercial, and intelligence satellites. Space-based assets carried over 80% of all messages to and from the US Central Command's (USCENTCOM's) area of responsibility (AOR). Satellite intelligence data was essential for planning the air campaign, critical for early warning of SCUD ballistic missile attacks, and aided in determining enemy positions and activities.[6] For the first time in any military campaign, Global Positioning System (GPS) satellites provided precise position information essential for navigation over an almost featureless desert terrain. Arguably, space "came of age" for warfighters in the Gulf War, but the situation was far from perfect.

US Space Command (USSPACECOM) traced some of the most significant problems from the Gulf War to a core issue—normalizing space operations for theater operators.[7] For example, since very little basic and operational doctrine existed, space preplanning for wartime

situations lagged well behind space technology. Because USCENTCOM had not articulated how spacepower ought to be used in their AOR and USSPACECOM was not fully prepared to provide "normalized" support, US military forces were largely uninformed and unprepared for using spacepower when Operation Desert Shield began. The normalization of space operations for theater operations is still not complete as of 1995. Spacepower doctrine and experience are still significantly lagging behind space technology. All three of these threads of development—technology, doctrine, and literacy/experience—are crucial, but the lack of balance is particularly important because it points to the focus of what should be the next phase of development in military space policy.

A definitive guide to the future focus of spacepower development requires sophisticated, cost-effectiveness and operational analysis. However it is possible to make a very useful, qualitative analysis based on recent experience and general assumptions about the relative costs and leverage of reforms. Are funds better spent on acquiring technology, improving experience, or developing doctrine? Which solution offers more leverage for the future?

After the Gulf War, the Air Force, Army, and Navy moved quickly to provide better spacepower support to the "warfighters." Senior Air Force leadership founded the Space Numbered Air Force (14th AF), activated the AF Space Warfare Center (SWC), and established space support teams (SSTs). Following the Air Force lead, the Army and Navy established their own space support teams. In general, US Space Command (USSPACECOM), all Service Components, and the national intelligence agencies attempted to provide better support to the combatant commands and more efficient pre-planning of existing space forces.[8]

Fourteenth AF is now responsible for war planning, readiness, and execution while serving as the Air Force warfighting component to USSPACECOM.[9] The AF activated the SWC to

refine doctrine, develop tactics, formulate concepts and demonstrate systems and technologies that improve military operations and the employment of space forces in warfare. Finally, all Service components, USSPACECOM, and intelligence organizations currently deploy space support teams to help conduct integrated space operations for the theater CINC.

In contrast to the significant reorganization of space forces, doctrinal changes were less dramatic. *Operational Air Force Space Doctrine* (AFDD 4) is still in coordination—it may be approved in 1995. Arguably the most important doctrinal manual, *Joint Doctrine; Tactics, Techniques, and Procedures (TTP) For Space Operations* (Joint Publication 3-14), was in coordination prior to the Gulf War and is still at least a year away from closure.[10] The space support teams mentioned above are available to deploy and support the warfighter, however, joint doctrine is still not available to guide their actions four years after the end of "the first information war."[11] Indeed doctrine lags, suggesting important near term focus for policy. The thesis of this study is that a lack of spacepower doctrine and experience caused the majority of the space related problems in the Gulf War. Further, while the space community has made efforts to normalize space operations since the war, the lack of doctrine and experience are still the major impediments to effective warfighting today and for future conflicts.

Focus

This study focuses on basic and operational Air Force and Joint space doctrine which was available to the principal space participants (USCENTCOM & USSPACECOM) prior to and during the Gulf War to include operation plans (OPLAN). Equally important, this study relies largely on the unclassified portions of the after action reports from these two Unified Commands, the Joint Chiefs of Staff Joint Universal Lessons Learned System (JULLS), the *Gulf War*

Airpower Survey (GWAPS), and the *Conduct of the Persian Gulf War: Final Report to Congress*. When possible, these documents were verified with primary sources.

Assumptions

The Gulf War validated the operational worth of space systems. Space-based communications, weather, navigation, surveillance and intelligence offered the warfighter capabilities unparalleled in earlier conflicts. The Gulf War provided a glimpse of how space control in the next century could be as imperative as air and sea control have been in this century.

In the next century, space will contribute significantly to national economic, political, and security objectives. Military, civil, and commercial space agencies have a need to develop space systems in a complementary, not competitive process. Within the DOD, cooperation is essential so that the information received from space assets continues to benefit warfighters. Outside the DOD, trust, spacepower literacy, and cooperation are critical to ensure efficient use of all space systems. The impact of spacepower for the future makes the thesis of this study all the more important.

Methodology

This study uses an inductive examination of the evidence to support the author's thesis. The following section illustrates the USCENTCOM and USSPACECOM space lessons from the Gulf War and generalizes these experiences into three threads of development: technology, experience, and doctrine. From that perspective, a description of the efforts to solve the problems from the war is offered. Subsequent to that, observations from this study lead naturally to future implications.

ESTABLISHING THE FRAMEWORK:

LESSONS FROM THE PERSIAN GULF WAR

> *. . . history, whatever its value in educating the judgment, teaches no lessons . . . Alternatively one might argue that a given conflict teaches many lessons: unfortunately, most of them are wrong.*
>
> —Sir Michael Howard

This section establishes a framework for analysis by organizing the lessons from after action reports, the *Gulf War Airpower Survey* (GWAPS), the *Conduct of the Persian Gulf War: Final Report to Congress* (CPGW), and other non-official works into three broad categories of spacepower development: technology, experience, and doctrine.[12] A lesson requiring the acquisition of new technology to resolve the issue is included in the *technology thread.* A lesson leading to or requiring the accumulation of new knowledge, literacy, skill, or reorientation is organized in the *experience thread.* For example, airpower strategists learned by World War II through experience that the first requirement for nearly all military operations was air superiority. Finally, a problem indicating a lack of a codified, sanctioned body of propositions to guide how spacepower ought to be used is attributed to a lack of *doctrine*. For the purposes of this study, doctrine includes not only formal, published doctrine, but also directives, manuals, and other official published guidance. This *common threads of development* paradigm is not foolproof, but it does offer a simple framework for analysis and a point of departure for future investigations. Using this three part framework, it quickly becomes obvious that the majority of the spacepower problems encountered during the Gulf War can be attributed to a lack of doctrine and experience. Unfortunately, the development of US space technology continues to outpace both doctrine and experience.

US Space Command After Action Report

"Normalizing[13] space support for the warfighters" is the common theme echoed by the authors of US Space Command's After Action Report.[14] The writers of this report made an obvious effort to address the importance of establishing and updating detailed space annexes (Annex N) in the warfighting Commander-in-Chief's (CINC) Operation Plans (OPLAN). Table 1 illustrates the lessons from the viewpoint of US Space Command and the corresponding category in the spacepower development process.

More preplanning required; Supported CINC OPLANs need work; and Include communication requirements in OPLANs. Space annexes to OPLANs either did not exist or were underdeveloped prior to the Gulf War. Prior to Operation Desert Shield, US Central Command's OPLAN did not address how spacepower would be used in the AOR.[15] In remarks to the 8th National Space Symposium in April 1992, Lt Gen Thomas S. Moorman Jr., the Vice Commander of Air Force Space Command during the Gulf War, confirmed this fact. He commented that if the US military learned anything from the Desert Storm example it was that preplanning is essential. "The best example of the lack of planning that we had is that General Horner went to war without a space annex—he did not have in his CENTAF operations plan a space annex."[16] As a result of the lack of preplanning, weather vans, ground antennas, intelligence terminals, and other space-related ground equipment were left off the Time-Phased Force Deployment List (TPFDL).[17] Inadequate preplanning is a theme common to all the reports analyzed for this study.

Table 1: USSPACECOM Lessons

LESSON	CATEGORY
More preplanning required—May not have six months of build-up for the next war.	Doctrine
Supported CINC OPLANs need work.	Doctrine
Include communication requirements in OPLANs.	Doctrine
Normalize all space support.	Doctrine & Experience
Normalize tactical warning support.	Experience & Technology
Operational control of military satellite communication systems remains fragmented.	Doctrine & Experience
Maintain the US multi-spectral imagery (MSI) capability.	Experience

Source: *USSPACECOM After Action Report,* 31 January 1992.

Normalize all space support; and normalize all tactical warning support. US Space Command did not fully realize or plan for the important role spacepower would play in other than a *strategic* mission. By 'normalizing' space support at the theater level, USSPACECOM now envisions operating its space systems as the Air Force operates its aircraft on a day-to-day basis. Through the documentation of these lessons, the authors not only highlighted the value of normalizing space support to the theater warfighter, they also ensured all readers would understand the significance of theater ballistic missile warning for the future. General Charles A. Horner, who had the unique experience of being the Joint Forces Air Component Commander during the Persian Gulf War and CINC USSPACECOM after the war, declared that the number one lesson of the Gulf War was that the US must develop a ballistic missile defense system capable of directly supporting the requirements of deployed forces as well as North America.[18] Normalizing space operations mandates the development of doctrine so that forces may organize, train, and equip to prepare for future wars.

Operational control of military satellite communication systems remains fragmented. Participants experienced the frustrations caused by a lack of centralized control of space

communication systems. While USCINCSPACE is given combatant command (COCOM) by the Chairman of the Joint Chiefs of Staff, no formal relationship exists between US Space Command and the managers of the several military satellite communication systems.[19] The operational control of these satellite systems remains fragmented among the various space agencies, services, and commands. This experience highlights the need for a centralized satellite communication structure in peacetime and war.[20]

Maintain US multi-spectral imagery (MSI) capability. The United States must decide whether to maintain its only MSI capability, the aging Land Satellite System (LANDSAT),[21] or to continue to rely on other nations for MSI support. Multi-spectral imagery proved to be very beneficial by providing US and coalition forces the opportunity to better understand and react to changes in the battlefield terrain. It will also offer future warfighters the ability to rehearse their missions, determine optimum tactics, and identify major threat lanes or attack axes to more effectively exploit training and technology in combat.[22] Finally, if the US Commerce Department continues to control LANDSAT on a day-to-day basis, agreements must be maintained to allow for peacetime military training and wartime control. While this lesson covers all three threads of the development process, experience is the core issue.

USCENTCOM After Action Report

The war fighter's perspective was somewhat different than US Space Command's perspective. US Central Command developed 500 Joint Universal Lessons Learned (JULL) after the war.[23] While USSPACECOM emphasized normalizing space operations, the supported command accented the need for better doctrine, training, and support from the experts. Table 2 is a compilation of the USCENTCOM lessons and the corresponding thread of spacepower's

development process. The lessons highlighted are not the only USCENTCOM lessons related to space operations, however, at the unclassified level they represent the vast majority of the spacepower problems discovered by USCENTCOM during the Gulf War.[24]

Table 2: USCENTCOM Lessons

JULL	CATEGORY
Better preplanning required for effective space support.	Doctrine
Doctrine required on the use of ground mobile force terminals.	Doctrine
USSPACECOM Liaison to CINCs required.	Experience
Space Demonstration Program.	Experience
NMIST critical for timely battle damage assessment (BDA).	Experience
Centralized control of theater communications must be exercised.	Experience
Space launch responsiveness.	Technology

Source: *USCENTCOM After Action Report,* 15 July 1991.

Better preplanning required for space support; and Doctrine required on the use of ground mobile force (GMF) terminals. After the war, USCENTCOM planners were acutely aware of how little useful spacepower doctrine existed. Spacepower doctrine was either non-existent or inadequate for the Gulf War. Through innovation and ingenuity during the six-month buildup of Operation Desert Shield, forces made spacepower work. However, a six-month buffer is a luxury the United States may not have in future conflicts.[25] In addition, as the Gulf War developed and grew, military forces needed more ground mobile force satellite communication terminals than doctrine prescribed and the TPFDL provided. The VII and XVIII Corps experienced shortages as a result.[26]

USSPACECOM Liaison to CINCs required; Space Demonstration Program; and National Military Intelligence Support Team (NMIST) critical for timely battle damage assessment (BDA). These lessons provided the impetus for the post war Space Support Team

(SST) concept.[27] Based on the Gulf War, USCENTCOM planners realized they did not have the expertise to effectively use spacepower. Their solution was to import the knowledge from the different space sectors for peacetime exercises and to continue having experts provide operational demonstrations of the capabilities provided by spacepower.[28]

Centralized control of communications. Because of the many sectors involved with satellite communications, initial control was, at best, fragmented.[29] Early in Operation Desert Shield, US Central Command assumed control of the validation process for all long haul strategic communications. Without centralized control, early deploying units might have used all available resources before hostilities began.[30] Unity of command in allocating the limited resources, satellite capacity, and frequency spectrum in particular, were vital to subsequent unit deployments.[31] The Persian Gulf War validated the importance of exercising centralized control of theater communications.

Space launch responsiveness. USSPACECOM did not have a booster to meet a CENTAF request to accelerate the launch of the next Defense Satellite Communications System (DSCS) satellite.[32] The DSCS satellite would have improved USCENTCOM's overly-taxed communications capability significantly. The inability of the US to launch satellites in a short period of time is a serious weakness.

Gulf War Airpower Survey

The GWAPS authors focused on describing the 'space product' and its operational impact. Even though the classified spacepower research by the GWAPS personnel is much more detailed, the unclassified report used here, tells a story consistent with that of the classified reports. This unclassified report addressed five central themes.

Planning and training for the use of space systems. In the areas where space capabilities were not fully integrated with doctrine and tactics (e.g., BDA and other intelligence functions), the importance of the five and a half months of Desert Shield preparation cannot be overemphasized.[33] While some annexes to USCENTCOM's Operation Plan 1002 were ample, weaknesses or omissions in other areas were inadequate for training or real-world events. In the cases where adequate doctrine existed, spacepower was used effectively. In cases where doctrine did not exist or was inadequate the results of space operations reflected the absence of in-depth preplanning.[34]

Space mobilization. The time to mobilize spacepower varied across the board. In some cases the equipment was immediately available due to peacetime requirements (e.g., F-16s equipped with Global Positioning System (GPS) receivers). In other cases the time to mobilize depended on preplanning, launch variables, and the availability of trained personnel.[35] If any one of these variables was deficient, a corresponding deficiency in mobilization was noted.

Military Utility of Space Systems. The contribution of spacepower was evident in terms of concrete warfighting results. In some cases, however, desired results could only be achieved by crossing functional boundaries. For example, the detection of SCUDS by the Defense Support Program (DSP) constellation required action from several of the Coalition Forces in order to destroy these mobile targets. The lesson here is that doctrine must provide the flexibility to cross functional boundaries.

Command and control of space systems. The highly classified, *strategic* focus of the US military space community was not suitable for the *tactical* environment of the Gulf War. The Cold War mentality of the space community oriented its support to *strategic* customers prior to the war (e.g., National Command Authority and various intelligence agencies). Complicating this

predicament, many of the key intelligence-related assets were not controlled by the warfighting commander.[36] After Operation Desert Storm, the space community realized wars in the future will likely require theater level support from space forces. This lesson also implies that centralized control of space systems by the warfighting commander is preferred over other arrangements.

The role of commercial space systems and receiver equipment. Commercial space systems played a significant role augmenting the military coalition forces. In addition, the coalition members cooperated to deny Iraq access to satellite imagery from France's commercial *satellite por l observation de la terre* (SPOT) system.[37] Military forces not only experienced the value of using commercial satellite systems, they now better understand the value of denying the enemy's use of commercial satellite systems.

Conduct of the Persian Gulf War: Final Report to Congress (CPGW)

As expected, the writers of the CPGW described the lessons and observations from the war in a much broader context than the sources previously cited.[38] They were also much more interested in describing weapons and technology than operational concepts. Table 3 illustrates the space-related shortcomings and issues from Volume II, Appendix K of the report.

Table 3: PGW Spacepower Shortcomings & Issues

SHORTCOMING/ISSUE	CATEGORY
The United States does not have a reactive space-launch capability.	Technology
Tactical warning capabilities must be improved.	Technology
GPS and most SATCOM are vulnerable to exploitation.	Experience
The aging LANDSAT system under Commerce Department Control must be replaced.	Experience & Technology
DSCS connectivity remained fragile due to age and condition of satellites and ground stations.	Experience & Technology
For future operations, planners must consider the challenges of operating within another nation's C3 infrastructure.	Doctrine & Technology
Military doctrine and training must institutionalize space-based support to operational and tactical commanders and incorporate it into operational plans.	Doctrine

Source: *CPGW Final Report to Congress, Volume II,* April 1992.

The United States does not have a reactive space-launch capability. This observation is a common theme addressed by the majority of the studies referenced for this study. US space launch, responsive or otherwise, continues to be a national problem. Efforts to resolve this issue are described in shortly.

Tactical warning capabilities must be improved. While US Space Command emphasized the lack of experience and the need for doctrine in this area, the writers of the CPGW illustrated the need for improved technology to solve the tactical ballistic missile warning problem. Specifically, they believe that in the future, an improved sensor to replace the DSP is appropriate.[39]

GPS and most satellite communications are vulnerable to exploitation. The Gulf War confirmed the need for the production, distribution, and integration of GPS receivers incorporating selective availability decryption. The Gulf War experience also proved the value of

fielding the MILSTAR satellite system and installing anti-jam modems for super high frequency (SHF) fixed-base satellite terminals and tactical ground mobile terminals.[40]

The aging LANDSAT system under Commerce Department Control must be replaced. The writers of the CPGW and USSPACECOM's After Action Report agree on this issue. The Gulf War experience validated the importance of maintaining an MSI capability available for military use.

DSCS connectivity remained fragile due to age and condition of satellites and ground stations. In the opinion of these authors, the older DSCS satellites and DSCS ground terminals require modernization. The experience from the war warrants an increase in the number of military satellites providing worldwide command and control coverage. In addition, procurement of smaller more mobile ground terminals, similar to a prototype used by the XVIII Airborne Corps, is needed to aid in transport to and within the theater.[41]

For future operations, planners must consider the challenges of operating within another nation s C3 infrastructure; and *Military doctrine and training must institutionalize space-based support to operational and tactical commanders and incorporated into operational plans.* The last two issues from the CPGW are similar to previous lessons from US Space Command and the GWAPS.

Status of the Lessons

US Space Command and US Central Command are the only two sources discussed with any type of formal approach to tracking the lessons of the Gulf War. However, either through omission or by design, none of the spacepower lessons from the Persian Gulf War are actively monitored by either of the unified commands today.[42]

After the Gulf War, USSPACECOM initiated action on many issues attributed to the Gulf War, even though they did not actively monitor the status of any of their lessons through a formal process. While issues such as the space support teams and better OPLANs received considerable attention and each lesson was assigned a point of contact (POC), no agency was assigned the responsibility for resolving the fate of those lessons. Because of this, it is difficult to determine with confidence which experiences from the Persian Gulf War USSPACECOM considered 'lessons' for the future and which experiences were discarded after some scrutiny. Without question the USSPACECOM lessons did receive some level of hearing immediately after the war—USSPACECOM initially disseminated 97 copies of their report to 13 agencies to include all warfighting CINCs.[43] While there was wide distribution of the lessons, the point is no mechanism existed to either discard a lesson as an anomaly, develop a solution, or elevate the problem to the Joint Chiefs of Staff for resolution.

In contrast, US Central Command inserted their lessons from the war into the Joint Universal Lessons Learned System (JULLS). This process required the command to evaluate the 500 lessons from the war and recommend what action should be taken for each. The recommendations ranged from designation as a 'noted item' to flagging a lesson as a remedial action project (RAP) requiring periodic monitoring until resolved.[44] However, after the spacepower lessons were routed through the JULLS process, none were designated remedial action projects.[45] This does not mean the space-related lessons were not considered important, only that other processes or programs may already incorporate a solution to those problems. The lessons from USCENTCOM received much wider dissemination due to their inclusion in the JULLS database. While neither of the principal unified commands during the Gulf War currently

monitors their respective lessons for resolution, USCENTCOM's lessons were adjudicated through a formal process.

Synthesis of the Lessons

In the development of spacepower, it is apparent from the studies examined that technology continues to surpass the progress of doctrine and experience. Arguably, the majority of lessons examined here were related to a lack of doctrine or a lack of experience (80%). The imbalance between space technology, doctrine, and experience is not a new phenomena, but it is commonly overlooked.

General Charles A. Horner has synthesized the most important spacepower problems from his unique perspective as the Joint Forces Air Component Commander during the war and as Commander-in-Chief US Space Command after the war. The first major problem he noted was the lack of experience US forces had in using space assets, especially with intelligence.[46] US forces simply were not familiar with using satellite constellations like the Defense Support Program (DSP) and Global Positioning System (GPS). The second significant problem General Horner noted was the over classification of space information.[47] The classified satellite products initially undermined the relationship between the United States and the coalition forces and was a major impediment in getting information to the warfighters. In General Horner's opinion, the way to resolve these problems is to shed the Cold War strategic heritage of space and to tear down the walls of classification the space intelligence community has built around themselves.[48]

In a separate work, Mackubin Thomas Owens reviewed a number of Gulf War studies and distilled all of the lessons to three principals.

> On first examination, these principles might seem so broad as to be trivial. Yet our lack of success in Vietnam demonstrates that we have not always paid as much attention to these principles as we should have. These lessons can be summarized as follows: people and organization; technology matters; and ideas (doctrine) matter.[49]

Technology, experience, and doctrine do matter. In order to maximize the potential of spacepower for future conflicts, it is evident from the material presented here that the United States needs to reassess the level of effort placed in developing spacepower doctrine and experience. Unfortunately, the inclination to be on the leading edge of technology often comes with a mutually strong penchant to disregard the teachings of the past.[50] The next section describes the efforts made since the war to improve these three developmental threads.

AFTER THE GULF WAR—UNEVEN IMPROVEMENT

> *The Air Force has a well understood, war-tested military doctrine for air power. The crux of the problem is Air Force insistence that the same doctrine applies to space.*
>
> —Kenneth A. Myers

It seems that the majority of the spacepower problems encountered during the Persian Gulf War resulted from a lack of spacepower doctrine and experience. Since the Gulf War, the development of spacepower remains uneven—doctrine and experience continue to trail behind technology. While the search for superior systems is required, until space doctrine is on an even plane with the emerging technology, the employment of spacepower will not be optimized. Space Operation Plans have improved; however, joint space doctrine remains unpublished. For example, while various space support teams (SSTs) are training regularly with the warfighters, no joint doctrine exists to guide them on command relationships or how the space portion of next war ought to be waged. Finally, new organizations designed to educate, train, and support the

warfighters are making headway to normalize space operations. The US military is making progress in all three threads of spacepower development, but at uneven rates of advance, with technology clearly in the lead—a circumstance due in part to the legacy of spacepower.

Spacepower's Legacy

The genesis of the American military space community's focus on research and development (R&D), vice operational support, began in response to the Russian launch of Sputnik in 1957. Following this event, the United States quickly became the world's leader in spacepower. However, the United States linked most military space development to support Cold War nuclear deterrent strategies. High strategic stakes caused tight security and aggressive technological development. Space became a highly classified technology-oriented operation, characterized by restricted access to information about satellite capabilities and created impediments to support the political and economic leadership in the United States.[51] This approach may have been appropriate for the Cold War; however, Operation Desert Storm and a different world environment indicated a change was in order. Changing this mentality has not come easily, nor is the process close to completion. In a major study after the Gulf War, commonly referred to as "The Wilkening Report," distinguished authors[52] advised then Vice President Quail of this reality. They warned that the Cold War security requirements continued to contribute to the inefficiencies in the conduct of the nation's space program.[53] The origin of spacepower in the United States established a pattern of development that has proven difficult to overcome.

The experience of space operators has also varied throughout history. In the early years, many aviators with extensive flying experience in World War II and Korea were the core space

operators. This changed in the mid 60's when the requirements of the Vietnam War stripped the space community of its flyers and hence its operational focus.[54] Since then, the highly classified space program developed the reputation for breeding a research and development vice operational mentality that has been difficult to overcome.

The Persian Gulf War was a turning point in revitalizing the operational focus for spacepower. In addition, in order to infuse more operational thinking into the space community, the Air Force merged Intercontinental Ballistic Missile (ICBM) operators into Air Force Space Command.[55] Although considerable effort has gone into overcoming the research and development heritage of the United States space community, the transformation is incomplete.

What Lessons Apply to the Future?

Before examining where senior military space leadership focused development efforts after the Gulf War, it is important to determine if the pursuit of a resolution is worthwhile. Pertinent to this question is the well known analysis of World War I airpower "lessons" developed by I.B. Holley, Jr.

> These lessons are much the same as those which might have been derived equally well from the Civil War or, for that matter, from any other war. As was true of former conflicts, World War I emphasized the necessity for a conscious recognition of the need for both superior weapons and doctrines to ensure maximum exploitation of their full potential.[56]

In other words, wherever military leaders fail to emphasize the need for better weapons in lieu of more weapons, they usually suffer serious disadvantage. When military leaders fail to formulate doctrine to exploit innovative weapons, they suffer further disadvantages.[57] In terms of technological development, the analysis thus far highlights the need for spacepower leadership to develop a responsive launch capability for the United States, ensure warfighters retain the ability

to acquire multi-spectral imagery, and develop a new system to provide theater ballistic missile warning. But equally important, this analysis suggests senior leadership should develop forward-looking spacepower doctrine to guide and educate warfighters.

In an era where spacepower is envisioned to perform many new missions with very limited resources, Dr. Holley's advice rings true. If the majority of the problems related to spacepower in the Gulf War fall into the categories of experience and doctrine, military leaders should be making every effort to formulate military doctrine to match the innovative space weapons. New doctrine will not only provide a direction for waging the next war, it can be used to train and educate warfighters on the applications spacepower can provide. Failing this, the nation may repeat the regretful pattern of the air weapon after World War I, recklessly groping forward with each technological innovation.[58]

The salient question is, have US military leaders apportioned spacepower development efforts appropriately between technology, experience, and doctrine since the Gulf War?

Technology

Spacepower leadership is aggressively seeking resolution to the technological problems encountered in the Gulf War. In general, the senior leadership continues to expand research and development of new space technologies. For example, funding for the Air Force Tactical Exploitation of National Capabilities (TENCAP) program, which contains the major classified and unclassified Air Force technology projects, has increased by an order of magnitude. At the unclassified level, the budget for TENCAP is now $35 million per year versus $3-4 million prior to the Gulf War.[59] While resolution of the technological problems is far from complete,

technology continues to receive an unbalanced portion of attention in the development of spacepower.

After the Gulf War, Air Force Space Command established the Space Warfare Center (SWC) to support combat operations through a variety of functions. One of its charters was to take the lessons learned in the Gulf War and apply them to day-to-day operations and wartime support.[60] Of note here is that the TENCAP program, well established prior to the Gulf War, dominates the SWC's functions and finances. After the war, TENCAP expanded its operation to leverage the billions of dollars spent on "National Technical Means."[61] The TENCAP system is organized using the previously classified code word *TALON* in six separate programs. The four principal technology divisions are Command, Control, Communications, Computers, and Intelligence (C4I) (TALON COMMAND), mission support (TALON READY), force application (TALON SHOOTER), and special operations (TALON NIGHT). TALON TOUCH and TALON VISION provide communications connectivity and processing power support to all the programs.[62] These technology programs dominate the SWC's day-to-day activities.

To normalize tactical warning support, the 11th Space Warning Squadron recently reached a milestone in theater missile warning. Its Attack and Launch Early Reporting to Theater (ALERT) system reached initial operating capability (IOC) on March 10, 1995.[63] The ALERT program was developed following the Gulf War to find better ways of using the Defense Support Program satellites for theater ballistic missile defense.[64] The technology acquired to secure this capability under the TALON SHIELD program responds to some of the lessons illustrated earlier. The ALERT program is a technological attempt to normalize and improve tactical warning support to the warfighting CINCs.

The lack of a responsive space launch capability is the subject of many studies and debates, but a decision addressing a long-term resolution to the problem is at least a year away.[65] This decision could result in an operational vehicle by 2005.[66] As described previously, the need for a responsive space launch capability in the Unites States was a significant lesson from the Gulf War. As a result, the FY 94 Defense Bill tasked the Secretary of Defense to provide a plan to improve the US launch capability. The result was General Thomas S. Moorman's Space Launch Modernization Plan which, in turn, led to Presidential Decision Directive/NSTC 4, "National Space Transportation Policy," issued on 5 August 1994.[67] The policy calls for a two-track effort. First, the short-term solution requires continued access to space by supporting and improving existing space launch capabilities—namely the Space Shuttle and current Expendable Launch Vehicles (ELVs). Second, the long-term goal is to pursue reliable and affordable access to space through focused investments in, and orderly decisions on, technology development and demonstration for next-generation reusable transportation systems.[68] President Clinton assigned responsibility for the next-generation reusable technology development/ demonstration program to NASA. He is scheduled to make a decision on the long-term solution no later than December 1996.[69] A technological scheme to solve the launch problem highlighted in the Gulf War rests with this decision.

In order to solve the problem of the United State's aging multi-spectral imagery (MSI) capability, US Space Command is working with the Office of the Secretary Defense to determine how to satisfy MSI requirements. Multi-spectral imagery was extremely beneficial during Operation DS/DS providing US and coalition forces the opportunity to better understand and react to changes in the terrain. It also offers future warfighters the ability to rehearse their missions, determine optimum tactics, and identify major threat lanes or attack axes to more

effectively exploit training and technology in combat.[70] However, the failure of LANDSAT 6 coupled with the Dod decision to stop funding for LANDSAT 7 leaves the military dependent on the aging LANDSAT 5 and foreign sources, such as the French SPOT system, to satisfy MSI imagery requirements.[71] In fact, during the Gulf War we relied exclusively on the French for MSI requirements.[72] The MSI working group has not resolved this issue but is committed to resolve the problem by the turn of the century.[73]

Experience

Several significant organizational fixes occurred after the Gulf War geared to improve spacepower experience and to normalize space support to the theater commanders. To solve some of the major problems witnessed in the Gulf War, senior Air Force leaders created the Fourteenth Air Force, the Space Warfare Center (SWC), the National Test Facility within the SWC, and the Space Support Team (SST) concept.

On 1 July 1993, the Air Force established 14th Air Force as its operational space component to US Space Command to integrate space support for theater warfare, organize space support to theater operators, and to train/exercise with space systems.[74] For the first time, airpower leaders organized spacepower in a familiar manner to mirror the way the rest of the Air Force operated. Fourteenth Air Force is now responsible for war planning, readiness, and execution. It serves as the warfighting component to USSPACECOM for satellite control, missile warning, communications, navigation, space surveillance, and space launch operations.[75]

Establishing 14th Air Force was one piece of the organizational solution enacted to resolve the problems from the Gulf War. In December of 1993, the Air Force conceived the Space Warfare Center (SWC). The SWC's charter is to *refine doctrine*, *develop tactics*, and

formulate concepts and capabilities to better apply space for all warfighters. Integral to the SWC are the wargaming and analytical capabilities embodied in the National Test Facility, also located at Falcon AFB, Colorado. The National Test Facility is responsible for helping educate, train, and prepare all warfighters for joint warfare by providing space scenarios for military exercises worldwide.[76] General Charles A. Horner, then the Commander-in-Chief of Air Force Space Command (CINC AFSPACECOM), originally envisioned the SWC to be Air Force Space Command's version of Red Flag and the Air Corps Tactical School all under one roof. He saw a need for an organization to develop the "space tactics and doctrines" while developing prototype programs under the TENCAP program.[77] In reality, SWC personnel are developing many new space technology ideas but very little spacepower tactics and doctrine.

Air Force Space Command implemented the final organizational change by developing Air Force Space Support Teams (AFSSTs).[78] US Space Command, the other service components, and intelligence agencies followed suit, with their version of this concept.[79] The AFSSTs will normally work with the Joint Forces Air Component Commander (JFACC) to provide space support.[80] At a minimum, SSTs from each of the three service components, USSPACECOM, and the National Reconnaissance Office (NRO) deploy to support all of the theater CINCs. Warfighting CINCs requested support from the SSTs in 20 exercises during 1994.[81] In a more recent exercise in South Korea, more than 15 separate SSTs deployed.[82] Many agencies are now "spring-loaded" to support the warfighter, but without the aid of Joint Space Doctrine to describe the relationship between the SSTs.[83]

The Space Warfare Center is also conducting space courses for different levels of training. First, the Space Tactics School completed its inaugural class in July of 1994.[84] This school (formerly the Space Tactics Instructor Course) was conceived by General Charles A. Horner to

give the career space and missile officers an avenue to improve their professional knowledge. In another attempt by General Horner to pattern spacepower after airpower, the STS was designed after the USAF Weapons School.[85] Its mission is to foster inter-agency "cross-pollination" so the best techniques and experiences can be transferred among the different elements of the space community.[86] The Air Force developed another training course for the Air Force Space Support Teams. This course is chartered to increase spacepower awareness and instruct personnel who assist the theater air component commanders and their staffs. Finally, a third spacepower training opportunity offers a 3-4 day orientation course designed for audiences with broad backgrounds, including senior leadership.[87] All of these courses are attempts to increase spacepower experience and literacy.

Doctrine

Warfighting commanders and service components are developing doctrines to guide the use of spacepower in the next war. In spite of these steps forward, doctrine remains well behind the gait of the spacepower's technological development. With the help of US Space Command, Fourteenth Air Force, the Space Warfare Center, and the Service Components, warfighting CINCs have made progress in developing their individual Operation Plans (OPLANs).[88] Air Force Operational Space Doctrine (AFDD 4) is nearing completion after years of coordination and may be signed by the Chief of Staff of the Air Force by July 1995.[89] Basic Air Force Doctrine (AFDD 1) is in the early stages of a major revision and is probably several years away from completion. Finally, Joint Space Doctrine (Joint Publication 3-14) has been in the coordination process since prior to the Gulf War.[90]

US Central Command OPLAN 1002-95. Prior to the Gulf War no doctrine was available to guide or educate USCENTCOM warfighters on spacepower. Since the war, USCENTCOM planners have incorporated a spacepower annex (Annex N) in their OPLAN describing specific space assets available for future planning. [91] While not a replacement for basic or operational space doctrine, Annex N to this OPLAN is a small step in the right direction. Nevertheless it does not provide the guidance needed to maximize spacepower's robust capabilities.

Air Force Manual 1-1. The current version of AF Manual 1-1, March 1992, assumes the same basic doctrine that applies to airpower applies to space—"aerospace power".[92] The next version of AF Manual 1-1, to be designated Air Force Doctrine Document (AFDD) 1, is expected to overturn this decision.[93] The drafters of AFDD 1 expect to separate airpower and spacepower into distinct roles and missions. This separation is a complete reversal of policy provided to the authors of the 1992 version. Based on the recommendations of the "Blue Ribbon" Todd Commission on Space, the writers of the 1992 version of AFM 1-1 were instructed to totally integrate air and space.[94] The Air Force's indecision on integration of air and space is yet another reason why space doctrine continues to flounder. As outlined, AFDD 1 will take the position that space capabilities cannot be derived by simply applying the term aerospace to what is an otherwise comprehensive "airpower" doctrine.[95]

Major AF commands will have an opportunity to include applicable spacepower experiences from the Gulf War into AFDD 1. It is difficult to predict when AFDD 1 will appear, but if it follows the same pattern as its predecessor it may be years away from completion.[96] It is too soon for the authors of AFDD 1 to predict how the spacepower experiences from the Persian Gulf War will affect the new document. [97]

Air Force Doctrine Document 4. If approved as currently written, AFDD 4 offers a small doctrinal step for space command, but a huge leap for the military space community. This document has been in coordination since the Gulf War and may be signed by General Ronald D. Fogleman, Air Force Chief of Staff, as early as July 1995.[98] If AFDD 4 is approved as currently written, many of the spacepower experiences from the Gulf War are addressed. For example, AFDD 4 describes command of space forces, roles and missions of space forces, space employment concepts, spacepower for the theater campaign, and education and training. All of these topics are directly related to the experiences of the Gulf War.[99] In fact, of the spacepower doctrinal documents examined in this study, the draft of AFDD 4 is the only reference with a general description of the relationship between the warfighting CINCs and the space support teams.[100] Although the current draft of AFDD 4 is a less robust version of previous drafts, it offers some relief in the doctrinal stalemate.

Joint Publication (Joint Pub) 3-14: Joint Doctrine; Tactics, Techniques, and Procedures (TTP) for Space Operations. Arguably the most important doctrinal document, Joint Pub 3-14, is no closer to completion than it was four years ago. The Joint Chiefs of Staff issued the program directive for Joint Publication 3-14 on 30 March 1990. USSPACECOM initiated plans to distribute the first, fully coordinated version of Joint Pub 3-14 by May 1991.[101] Unfortunately, the publication is mired in the coordination process and will be rewritten prior to another coordination cycle.[102] Joint Pub 3-14 is the most important doctrinal reference, not only because future operations are likely to be joint efforts, but also because the Chairman of the Joint Chiefs of Staff recently included a statement in all Joint Publications stipulating they will be followed except when in the judgment of the commander, exceptional circumstances warrant otherwise.[103] This is

especially important for joint space operations because of service, unified, and national space support teams augmenting the joint force commander's staff during war.

Spacepower's Development After The Gulf War

Efforts to address the problems encountered during the Gulf War are evident in all phases of the development of spacepower, but it is apparent that technological innovations still receive an unbalanced share of spacepower attention. The development of Air Force Basic Doctrine, Air Force Operational Space Doctrine, and Joint Space Doctrine are all embarrassingly far behind innovative space technologies.

The disdain of space doctrine is a well documented fact. In January 1988, Colin S. Gray made the following comment about space doctrine. "It has been 43 years since the first spacecraft was launched (Germany's V-2 rocket) and 30 years since Sputnik, yet today there is no doctrinal literature worth reading on the subject of battle field space."[104] Colin Gray's statement is as accurate today as it was in 1988. Later, Lt Col Alan J. Parrington made similar comments in the *Airpower Journal.*

> The United States has not decided what it wants to do in space, how it can achieve its aims, or what equipment it needs for future space exploration. If the US government is to eliminate confusion and give direction to the space program, it must first develop a cohesive military space doctrine.[105]

Col Edward C. Mann III. supports Parrington's declaration by summarizing the short shrift many Air Force Officers give Air Force basic doctrine in a recent publication, *Thunder and Lightning.* "Boring or not, when the popes (chief of staff), cardinals (four-star generals), and archbishops (three-star generals) disdain doctrine, the faithful will follow suit."[106] Finally, Lt Col Steven J. Bruger describes the actions needed to prepare US space forces for the "Next Space War." Bruger states, "The first need is a key element—development of space doctrine to provide

guidance and direction at all levels of war, across the full spectrum of conflict."[107] The development of space doctrine at all levels has been and continues to be the largest impediment facing the military space community today.

CONCLUSION

> *. . . we need joint doctrine that clearly defines space control and force application to support the evolution of space systems from a pure supporting role into a menu of joint space force options whose stated purpose is to ensure overall US space superiority.*
>
> —Moore, Budura, and Johnson-Freese in JFQ

Summary of Findings

The overwhelming majority of the documented lessons in the Gulf War concerned either a lack of doctrine or a lack of space literacy/experience—the military space community is years away from internalizing these experiences. While the space community pursues ideas to normalize spacepower operations, doctrine is an after thought—"dull, boring, and useless," or "important but not read by warriors."[108] Specifically, the lack of doctrine continues to impede efforts to maximize effective warfighting with spacepower assets. Less costly reforms in doctrine could offer more leverage for the future US Military Space Program when combined with the existing spacepower technology. The synergy of improvements to AFDD 1, approval of AFDD 4, and the creation of Joint Space Doctrine offer a cost-effective boost to the advancement of spacepower for the future. General Thomas S. Moorman Jr., Vice Chief of Staff of the Air Force, feels the complete internalization of spacepower lessons from the Gulf War is at least a generation of warfighters away.[109] More focus on doctrine can accelerate the internalization of recent spacepower experiences. The impact of redressing the imbalance existing in the development of

spacepower makes the thesis of this study a prime consideration for the next logical step in future spacepower policy.

Primary Conclusions

(1) The majority of spacepower lessons from the Gulf War resulted from a lack of doctrine and experience.
(2) Technology remains the military space community's primary focus—doctrine and experience continue to lag well behind technology in the development of spacepower.
(3) Space doctrine development is long overdue. For example, Joint Space Doctrine will not be available for at least another year.
(4) US Space Command did not have a formal process of monitoring the spacepower lessons after the Gulf War.[110]
(5) Spacepower advancement is still impeded by the Cold War mentality and the extreme security requirements associated with this era.

Recommendations

Doctrine. The US space community should focus on redressing the imbalance between doctrine, experience, and technology in spacepower's development. Between the Gulf War lessons, the US Space Command exercise database, and the Joint Universal Lessons Learned System, sufficient historical information is available to help write useful spacepower doctrine. In particular, Joint Publication 3-14 is urgently needed to help guide the influx of space support teams in theater exercises. After approval, Operational Air Force Space Doctrine (AFDD 4) can potentially serve as an accurate guide for the rewrite of the spacepower portion of Basic Air Force Doctrine (AFDD 1). Finally, the US military space community is dangerously close to completely discarding forward thinking in space doctrine. We must reverse this mindset to ensure doctrine guides the development and employment of future space systems.

Experience. The development of space doctrine and the liberation of the space community from the security restrictions of the Cold War paradigm will spur education concerning the attributes of spacepower. All Services will benefit from the development of space

doctrine because it can serve as the basis for spacepower professional military education (PME). An aggressive spacepower PME program, from basic training to the senior service schools is the only way to fully internalize spacepower lessons. In addition, a major step forward in educating the force and to establish core competency would tear down the walls of classification the military space intelligence community has built around themselves. The United States will be better served by establishing a single military space sector with representation from all the services. The current ultra secret intelligence space sector is very resilient[111] but inefficient. In short, the United States should "give the warfighting CINCs more control over intelligence support."[112]

Technology. The integration of all military and intelligence space activities will not only increase the warfighting CINC's influence on spacepower support, it will help centralize the acquisition, control, and tasking of satellites. The military space community must continue to search for superior weapons and force multipliers—this is an essential requirement. However, the current acquisition and management of military satellites is fragmented. The recent Report of the Commission on Roles and Missions of the Armed Forces supports this finding. The commission recommends that the Secretary of Defense integrate the management of military and intelligence space activities; assign military space systems integrated architecture development to a joint Service office; and designate the Air Force as the primary (not sole) agency for acquisition and operation of multi-user space-based systems.[113] These changes will make the already aggressive development of spacepower technology much more efficient.

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Advisor: Col Dennis Drew (ret)
Reader: Dr James Corum

Notes

[1] Many authors make reference to the Persian Gulf War as the 'first space war,' however, since we have used space assets in warfare since Vietnam, it seems more appropriate to call Operation Desert Storm the 'first information war.' This is the first time a war revealed just what impact information management can have. James A. Winnefeld, Preston Niblanck, and Dana J. Johnson, *A League of Airmen: US Airpower in the Gulf War*, (Santa Monica, California: RAND Project Air Force, 1994) 4, 181-184.

[2] In AFM 1-1, spacepower is defined as "That portion of aerospace power that exploits the space environment for the enhancement of terrestrial forces and for the projection of combat power to, in, and from space to influence terrestrial conflict." This definition originated in a draft to AFM 2-25 which no longer exists. Another definition is found in the current draft of AFDD 4, "Spacepower is the capability to exploit civil, commercial, intelligence, and national security space systems and associated infrastructure to support national security strategy and national objectives from peacetime through combat operations." This study will use the AFDD 4 definition. *AFM 1-1, Basic Aerospace Doctrine for the United States Air Force*, vol. II, March 1992, 300. *AFDD 4, Operational Space Doctrine for the United States Air Force*, Draft, 1 May 1995, 3.

[3] Many of the reports analyzed for this thesis use the words *strategic* and *tactical* to differentiate between missions to support the nuclear deterrence strategy of the United States and other than nuclear missions respectively. Strategic and tactical are more appropriately used in terms of levels of war or effects during war. For a useful definition, see Colonel John A. Warden, *The Air Campaign* (New York: Pergamon-Brassey's, 1989): 2-3.

[4] Lt Col Mike Wolfert, address to the Space Issue Team on Roles and Missions, Washington DC, 14 November 1994, slide S2-OVER 3.

[5] *Gulf War Air Power Survey*, vol. IV, "Weapons, Tactics, and Training and Space Operations," (Washington DC: Department of the Air Force, 1993), 169. (Hereafter cited as GWAPS)

[6] General Merrill A. McPeak, address during the SPACE TALK '94 Briefing, 16 September 1994.

[7] *US Space Command Operation Desert Shield and Desert Storm Assessment* (S/NF), (Peterson AFB, CO: USSPACECOM, 31 January, 1992): 65-67, and *US Central Command After Action Report, Operation Desert Shield/Storm*, (S/NF) (MacDill AFB, FL: USCENTCOM, 15 July, 1991): 37-47. Information extracted from both reports is unclassified. (Hereafter cited as USSPACECOM AAR & USCENTCOM AAR).

[8] Joint Chiefs of Staff (JCS), *Joint Doctrine; Tactics, Techniques, and Procedures (TTP) For Space Operations* (Washington DC: JCS , 15 April 1992, Final Draft) VI-5. (Hereafter cited as Joint Pub 3-14).

[9] General Thomas S. Moorman, Acquisition Conference Remarks, 27 May 1994, 2.

[10] At the most recent Joint Space Doctrine working group meeting, USSPACECOM/J5, Maj William Doyle stated that Joint Pub 3-14 will be rewritten. He projected the document to be in final coordination 12-14 months from this meeting. Maj William Doyle, "Joint Space Doctrine Working Group," Peterson AFB, Colorado, 31 May-1 June 1995.

[11] Moorman, 7.

[12] This concept was adopted from Colonel Dennis M. Drew, USAF (Retired). Colonel Drew presented this framework on 2 May 1995 during the School of Advanced Airpower Studies Course 680 "Airpower Theory II." For a similar framework see Mackubin Thomas Owens, "Lessons of the Gulf War," *Strategic Review*, (Winter 1992): 51.

[13] A useful definition comes from James W. Canan in "'Normalizing' Space" *Air Force Magazine*, (August 1990): 12. Mr Canan defines 'normalizing' as follows: "This means launching and operating its space systems as matter-of-factly and purposefully as it does its aircraft and treating those systems as workaday and warfighting tools, not as showpieces in the sky." I would add "Acclimating the Cold War space culture into everyday operational life."

[14] USSPACECOM AAR, 65.

[15] USCENTCOM OPLAN 1002-90. Historical Research Agency, Maxwell AFB Alabama. Viewed December 1995.

[16] Lt Gen Thomas S. Moorman Jr., Remarks to the 8th National Space Symposium, Colorado Springs, Colorado, 2 April 1992, 1.

[17] Moorman, 1.

[18] General Charles A. Horner, Prepared Statement to the Senate Armed Services Committee, "Space Seen As Challenge, Military's Final Frontier" *Defense Issues* 8, no. 34, (April 22 1993): 1.

[19] USSPACECOM AAR, 67.

[20] USSPACECOM AAR, 67.

[21] "Joint Universal Lessons Learned System (JULLS) Database" on CD-ROM, Navy Tactical Information Compendium (NTIC) (S/NF),(Washington DC: Department of the Navy, December 1994) Disk 2, JULL 92659-18177. Also, *Conduct of the Persian Gulf War Final Report to Congress*, vols. I & II, (Washington DC: Department of Defense, April 1992), K 50-51. (Hereafter cited as the CPGW).

[22] Lt Gen Thomas S. Moorman Jr., Remarks to the Space Acquisition Conference, Colorado Springs, Colorado, 27 May 1994, 4.

[23] USCENTCOM AAR, 37.

[24] USCENTCOM AAR, 37-47.

[25] Michael M. Garrell, *There are No Space Wars, How Do CINC s Fight Using Space Forces?* (Newport RI: Naval War College, 17 June 1994), 17. Garrell argues that it is clear from the post war analysis that the successful use of spacepower was due largely to innovation, creativity, and ad hoc procedures, not operational thinking.

[26] JULL 31538-21500.

[27] USSPACECOM Joint Space Support Team (JSST) Briefing, USSPACECOM/J33S, undated, slide J3-1-30-10.

[28] JULLs 50352-59445 & 91747-98856.

[29] Lt Col Steven J. Bruger, "Not Ready for the First Space War, What about the Second?" *Naval War College Review* 18, no. 1, (Winter 1995): 76. Also, CPGW, K 31.

[30] JULL 15242-11100.

[31] JULL 15242-11100.

[32] JULL 50612-18818.

[33] GWAPS, v.

[34] GWAPS, v.

[35] GWAPS, v-vi.

[36] GWAPS, vi.

[37] GWAPS, vi.

[38] CPGW, ix & K 50 respectively.

[39] CPGW, K 49.

[40] CPGW, K 48, 49.

[41] CPGW, K 48.

[42] Lt Col Robert E. Miller, Chief of US Space Command's Joint Training and Simulation Section, USSPACECOM J33Z, personal interview on USSPACECOM lessons learned, Peterson AFB Colorado, 1 June 1995.

[43] USSPACECOM AAR, Attachment 2.

[44] Mr Mark G. Cooney, Joint Chiefs of Staff (JCS) J7/Evaluation and Analysis Division, telephone interview on the JULLS process, 1 May 1995. For a detailed description of the JULLS process, see CJCS Instruction 5716.01, 1 Oct 94, B-1.

[45] Cooney interview.

[46] General Charles A. Horner, telephone interview on spacepower in the Gulf War, 28 April 1995.

[47] Horner interview.

[48] Horner interview.

[49] Owens, 51.

[50] For an enlightening view of doctrine, see Lt Col Dennis M. Drew, "Of Trees and Leaves; A New View of Doctrine," *Air University Review*, (Jan-Feb 1982): 40-48.

[51] Lt. Gen. Thomas S. Moorman, Jr., Speech to the San Francisco Commonwealth Club on 'Creating Tomorrow's Space Forces,' San Francisco, California, 1 December 93.

[52] The writer's of the Wilkening Report include Laurel L. Wilkening—Appointed by President Reagan in 1985 as the Vice Chairman of the National Commission on Space; Lt. General James A. Abrahamson, USAF (Retired.)—First Director of the Strategic Defense Initiative; Edward C. ("Pete") Aldridge—Former Secretary of the Air Force; Joseph P. Allen—Former astronaut with NASA; Daniel J. Fink—Over 40 years in aerospace engineering experience; John S Foster, Jr.—Former Director of Lawrence Livermore National Laboratory; Edward Frieman—Former Director of Energy Research with the DOE; Don Fuqua—Served 12 terms as a US Congressman; General Donald J. Kutyna, USAF (Retired.)—Former commander of NORAD & AF Space Command; John M. Logsdon—Author of *The Decision to Go to the Moon: Project Apollo and the National Interest*; and Bruce C. Murray—Former Director of NASA/California Institute of Technology Jet Propulsion Laboratory. *A Post Cold War Assessment of US Space Policy; A Task Group Report.* (Washington DC: Department of Defense, 17 December 1992), Appendix II. (Hereafter cited as the Wilkening Report)

[53] Wilkening Report, 23.

[54] Lt Col Mike Wolfert, Chief of Air Force Space Command Strategy, Policy, and Doctrine, personal interview on spacepower in the Gulf War, 1 June 1995.

[55] Public Affairs Background for Query Response prepared for Lt. Gen. Moorman, June 30, 1993. Effective date of the transfer was 1 July 1993.

[56] I B Holley, Jr., *Ideas and Weapons* (Washington DC: Office of Air Force History, 1983) 175.

[57] Holley, 175-176.

[58] Holley, 178.

[59] Major Joe Squatrino, Space Issues Committee, Air Force Roles and Missions, telephone interview on the future of spacepower, 15 May 1995.

[60] Lt. Col Kip Hunter, "TALON Programs Overview" *The Space Tactics Bulletin* 1, no. 1, (June 1994): 5.

[61] Col Mike Francisco, "SWC Support to Warfighters" *The Space Tactics Bulletin* 1, no. 1, (June 1994): 3.

[62] Hunter, 5.

[63] Capt John Kennedy, "Theater Missile Warning Unit Reaches Operations Milestone" *The Guardian* (April 1995): 13. Also see Sean D. McClung, "TALON SHIELD Declares Victory!" *The Space Tactics Bulletin* 2, no. 1, (November 1994): 3.

[64] Kennedy, 13.

[65] *Space Launch Modernization Study*, (Washington DC: Department of Defense, 18 April 94) 17-19.

[66] *NASA Implementation Plan for the National Space Transportation Policy*, November 7, 1994, 13.

[67] NASA Implementation Plan, 3.

[68] NASA Implementation Plan, 3.

[69] NASA Implementation Plan, 3.

[70] Lt. Gen. Thomas S. Moorman Jr., Space Acquisition Conference Remarks, Colorado Springs, Colorado, 27 May 1994, 4.

[71] General Charles A. Horner, "Testimony before the Senate Armed Services Committee" March 1994, 25.

[72] Wolfert interview.

[73] Wolfert interview.

[74] Moorman, Space Acquisition Conference Remarks, 2.

[75] Moorman, Space Acquisition Conference Remarks, 2.

[76] Lt. General Thomas S. Moorman, presentation to the Committee on Appropriations, Subcommittee on Defense, US House of Representatives, Washington DC, March 1994, 5.

[77] Moorman, Presentation to the House, 5-6.

[78] AFDD 4, 10.

[79] General Joseph W. Ashy, Commander-in-Chief, US Space Command, remarks to the Orlando Air force Association, Orlando, Florida, Undated, 6.

[80] Ashy, 6.

[81] USSPACECOM JSST Briefing, slide J3-1-30-12.

[82] Wolfert interview.

[83] Maj. William Doyle, Joint Space Doctrine Working Group, Joint Publication 3-14 Working Group, USSPACECOM/J5X, Peterson AFB, Colorado, 31 May-1 June 1995. (Author attended the session)

[84] Lt. Col Dan Chapman, "Space Tactics School (STS) Completes Inaugural Class" *The Space Tactics Bulletin* 2, no. 1, (November 1994): 4-5. Captain David Koster, "Space Training—Coming Soon to a Theater Near You!" *The Space Tactics Bulletin* 2, no. 1, (November 1994): 5-6.

[85] Chapman, 4.

[86] Chapman, 4.

[87] Brigadier General David L. Vesely, "Commanders Corner" *The Space Tactics Bulletin* 2, no. 1, (November 1994): 1.

[88] General Charles A. Horner, Joint Forces Air Component Commander during the Gulf War, Telephone interview on spacepower in the Gulf War, 28 April 1995.

[89] Wolfert interview.

[90] Joint Space Doctrine Working Group.

[91] Moorman, Space Acquisition Conference remarks, 4. USCENTCOM OPLAN 1002-95, undated, submitted on 1 June 1993. This OPLAN was never approved. Annex N is currently a general list of capabilities but does not provide guidance on how to use spacepower to fight the next war.

[92] AFM 1-1, vol. I, 5.

[93] AFDD 1, outline Chapter 3.

[94] Colonel Dennis M. Drew, USAF (Retired), project team chief and principal author of the 1992 version of AFM 1-1, personal interview on the integration of spacepower in AFM 1-1, 12 June 1995.

[95] Colonel Kenneth A. Myers and Lt Col John G. Tockston. "Real Tenets of Military Space Doctrine," *Airpower Journal*, (Winter 1988): 55. Also, see Maj Grover E. Myers, "Aerospace Doctrine: We're Not There Yet," *Air University Review*, (Sep-Oct 1986): 91-93.

[96] AFM 1-1, vol. I, i. The time period between the latest two versions of AFM 1-1 was eight years and two months. If the next version follows the same pattern, AFDD 1 will be available at the turn of the century.

[97] AFDD 1, outline. Also, Mr Wayne Wiliamson, principal author of AFDD 1, Air Force Doctrine Center, telephone interview on AFDD 1, 15 June 1995.

[98] Wolfert interview.

[99] Wolfert interview. Also, reference Chapter 2 of this study.

[100] AFDD 4, 8-10. Also, Joint Space Doctrine Working Group.

[101] Joint Chiefs of Staff Program Directive for Joint Pub 3-14, Message date time group, 301638Z MAR 90, Washington DC, 1.

[102] Joint Space Doctrine Working Group.

[103] It is also important to note that, "If conflicts arise between the contents of this publication and the contents of Service publications, this publication (Joint Pub 3-14) will take precedence for the activities of joint forces. . ." Joint Pub 3-14, ii. It is the opinion of this author that the doctrinal community as a whole has taken these statements as license to avoid development of forward-looking doctrine. During the most recent Joint Space Doctrine Working Group, all Service representatives indicated that their senior leadership has interpreted these "directive" statements to mean that doctrine cannot include futuristic guidance. If a space mission (force application) is not possible today because of politics or funding, it should not be described in any doctrinal publication. This thinking is a step backward in doctrinal development, especially for space-based assets. Spacepower's operational potential will be maximized in the future. The Gulf War is only a glimpse of what the US will benefit from robust spacepower capabilities.

[104] Colin S. Gray. "Space Warfare; Part I The Need for Doctrine" *National Defense*, January 1988, 25.

[105] Lt Col Alan J. Parrington. "US Space Doctrine: Time for a Change?" *Airpower Journal*, Fall 1989, 51.

[106] Colonel Edward C. Mann III. *Thunder and Lightning; Desert Storm and the Airpower Debates*, (Maxwell AFB Alabama: Air University Press, 1995) 164-165. Also see Col Mann's description on page 181: "As such, war is subject to all the vagaries of the human mind, spirit, and will. So long as this is true, ideas, concepts, philosophies, and doctrines will always matter."

[107] Lt Col Steven J. Bruger, "Not Ready for the First Space War, What About the Second?" *Naval War College Review* 18, no. 1, (Winter 1995): 79.

[108] Mann, 164.

[109] General Thomas S. Moorman, Jr., Vice Chief of Staff of the Air Force, Personal Interview, Maxwell AFB, Alabama, 5 June 1995. I agree with General Moorman that until Air Force personnel can communicate the importance of spacepower from the ranking General Officer to the Basic Airman, and until we have spacepower advocates or heroes (as we did with airpower), only then will we fully internalize the lessons from the war.

[110] Recently, USSPACECOM, instituted a program to monitor lessons from any exercise to which the Joint Space Support Teams deploy. USSPACECOM will monitor all lessons from these exercise and will submit significant findings to the Joint Chiefs of Staff (J7) for inclusion in the Joint Universal Lessons Learned System. Miller interview.

[111] Reports indicate the ultra-secret space programs are likely to remain tightly veiled, especially in the National Reconnaissance Office. James M. Gifford, "New Clinton Policy Aims To Reduce Government Secrecy," *Space* News, (April 24-30 1995): 14.

[112] "Directions for Defense; Report of the Commission on Roles and Missions of the Armed Forces," (Arlington, Virginia: Department of Defense, 1995): 2-6, 2-7.

[113] Ibid., 2-7.

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